

8 an n-channel field effect transistor portion provided on the p-type
9 silicon substrate, corresponding to the field emission electron source portion,

10 wherein:

11 the field emission electron source portion is provided in a drain
12 region of the field effect transistor portion; and a control voltage is applied to a
13 gate electrode of the field effect transistor portion to control a field emission
14 current from the field emission electron source portion;

15 the drain region includes different impurity elements and includes at
16 least two wells having different impurity concentrations having symmetrical
17 impurity distributions; and

18 of the at least two wells, one well having a low impurity
19 concentration is provided around a circumference of the other well having a higher
20 impurity concentration.

1 4. (As Amended) A field emission type electron source device
2 comprising:

3 a field emission electron source portion including an extraction
4 electrode provided on a p-type silicon substrate via an insulating film and having
5 an opening portion at a position corresponding to a region where a cathode is
6 provided; and a cathode portion provided on the p-type silicon substrate and at a
7 position corresponding to the opening portion of the extraction electrode; and

8 an n-channel field effect transistor portion provided on the p-type
9 silicon substrate, corresponding to the field emission electron source portion,

10 wherein:

11 the field emission electron source portion is provided in a drain
12 region of the field effect transistor portion; and a control voltage is applied to a

13 gate electrode of the field effect transistor portion to control a field emission
14 current from the field emission electron source portion;

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15 the gate electrode of the field effect transistor portion has a shape
16 such that a portion of the gate electrode nearer the drain region has a total width
17 wider than a total width of a portion of the source electrode nearer the source
18 region; and a part of the gate electrode is provided in such a manner as to cover an
19 end of the drain region.

1 5. (As Amended) A field emission type electron source device
2 comprising:

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3 a field emission electron source portion including an extraction
4 electrode provided on a p-type silicon substrate via a first insulating film and
5 having an opening portion at a position corresponding to a region where a cathode
6 is provided; and a cathode portion provided on the p-type silicon substrate and at a
7 position corresponding to the opening portion of the extraction electrode; and

8 an n-channel field effect transistor portion provided on the p-type
9 silicon substrate, corresponding to the field emission electron source portion,

10 wherein:

11 the field emission electron source portion is provided in a drain
12 region of the field effect transistor portion; and a control voltage is applied to a
13 gate electrode of the field effect transistor portion to control a field emission
14 current from the field emission electron source portion;

15 the drain region including at least two wells having different
16 impurity concentrations, a first of the at least two wells being provided around a
17 circumference of the second of the at least two wells;

18 a gate insulating film is provided between the gate electrode of the
19 field effect transistor and the p-type silicon substrate; the gate insulating film

20 includes a film thinner than the first insulating film, the first insulating film being
21 provided between the extraction electrode and the p-type silicon substrate; and the
22 gate insulating film is buried with the first insulating film.

Please add the following new claims 14-17:

1 14. (Newly Added) A field emission type electron source device
2 according to claim 1, wherein the extraction electrode is provided in a region
3 above the drain region and away from an interface between regions of different
4 impurity concentrations.

1 15. (Newly Added) A field emission type electron source device
2 according to claim 4, wherein the extraction electrode is provided in a region
3 above the drain region and away from an interface between regions of different
4 impurity concentrations.

1 16. (Newly Added) A field emission type electron source device
2 according to claim 5, wherein the extraction electrode is provided in a region
3 above the drain region and away from an interface between regions of different
4 impurity concentrations.

1 17. (Newly Added) A field emission type electron source device
2 according to claim 7, wherein the extraction electrode is provided in a region
3 above the drain region and away from an interface between regions of different
4 impurity concentrations.